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Cite as: AIP Conference Proceedings **2235**, 020031 (2020); https://doi.org/10.1063/5.0007488
Published Online: 04 May 2020

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Effect of Adding Lycium barbarum Extract to Drinking Water on Some Physiological Characteristics of Japanese Quail (Coturnix japonica)

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ABSTRACT: This study aimed to investigate the effect of adding Lycium barbarum extract to drinking water on some physiological characteristics of Japanese quail. A total of 270 one-week-old Japanese quails was used in this study. The birds were divided into six treatments (45 for each). Each liter of drinking water was treated with 400 mg of Lycium barbarum extract add from (leaves, fruits, stems, and roots) for T2, T3, T4, and T5 respectively. 400 mg of mixed extract from leaves, fruits, stems and roots of Lycium barbarum were added to drinking water (T6). The control treatment (T1) was without of Lycium barbarum drinking water. The results showed a significant decrease ($P< 0.05$) in the age of sexual puberty and maturity for males and females were recorded in third treatment compared to control. On the other hand, the results showed no significant differences between the experimental treatments for the weight at sexual puberty and maturity for males and females. The results showed a significantly increase ($P< 0.05$) in the relative weight of testes, sperm viability %, and individual motility% in third treatment compared to the control. Also, the results showed a significant decrease ($P< 0.05$) in dead sperm % and abnormality % were recorded in the third treatment compared to the control. It can be concluded that the fruits of Lycium barbarum extract improved the vitality of sperms and reproductive characteristics of Japanese quail.

Keywords: *Lycium barbarum, Reproductive characteristics, Quail.*

INTRODUCTION

Lycium barbarum, a member of the Solanaceae plants family, is a functional food (Zhang et al., 2013). In China, Tibet, and other Asian Nations, Lycium barbarum has been commonly grown and it's commonly used as a herb and as a complement in traditional Chinese medicine for more than 2,000 years for the benefit of anti-aging, vision, kidney and liver function (Cheng et al., 2015). Recent studies have shown that extracts of Lycium barbarum are used to help these typical characteristics. Lycium barbarum has a range variety of biological activities, including effects on aging, neuroprotection, anti-fatigue, endurance, enhanced metabolism, glucose control in diabetics, glaucoma, anti-oxidant characteristics, immunomodulation, anti-tumor activity and cytoprotection (Potterat 2010). Scientists have been studied in order increase growth rate of livestock using helpful herbs (Bunyapraphatsara 2007). Lycium barbarum has been used in China for over 1000 years as herbal medicine to enhance fertility (Luo et al., 2006). Lycium barbarum can not only increase antioxidant enzyme activities and inhibit cell death but also increase male spermatogenicity (Shi et al., 2017). Previous studies reported that Lycium barbarum can significantly decrease spermatogenic cell apoptosis and enhance sperm parameters owing to its high oxygen radical scavenging activity (Luo et al., 2014). Lycium barbarum can exert functional growth of male sexual dysfunction and loss of fertility due to diabetes in male mice. The advantages of these herbs are significant for animals' health (Javed et al., 2009). A little published data is concerning the use of Lycium barbarum, as a natural feed additive in poultry drinking water. Therefore, the aim of this study is to investigate the effect of adding Lycium barbarum extract from drinking water on reproductive characteristics of Japanese quail.

MATERIAL AND METHODS

This study was conducted at the quail farm, College of Agriculture, University of Basrah. A total of 270 Japanese quail (Coturnix japonica) one week old with an average initial body weight of (27.96 gm) were used in this study. Chicks were randomly distributed into six treatments with three replicates each. Each liter of drinking water was supplemented with 400 mg of Lycium barbarum extract (leaves, fruits, stems and root) T2, T3, T4, and T5 respectively, T6: add 400 mg of Lycium barbarum extract of the mixture of leaves, fruits, stems and roots (100 mg

International Conference on Emerging Applications in Material Science and Technology
AIP Conf. Proc. 2235, 020031-1–020031-5; https://doi.org/10.1063/5.0007488
Published by AIP Publishing. 978-0-7354-1994-0/$30.00

each) per liter of drinking water. First treatment (T1): the control treatment without any drinking water supplement. Chicks were housed in quail's cages under the same condition and rearing system. Chicks were fed approximately 24% crude protein; 2900kcal/kg metabolizable energy until three weeks of age, then, they received commercial quail diet (20% crude protein; 2900 kcal/kg metabolizable energy) (NRC 1994). Water and feed were ad libitum till the end of the study.

EXTRACT PREPARATION

Plant parts shall include (leaves, fruits, stems, and root) washed carefully to remove dirt and dried under ambient temperature. Dry parts were ground using laboratory blenders to form a coarse powder. 50g of the powder was mixed into 250 ml of ethanol in a clean glass beaker. The beaker was sealed and allow for 24hrs in a water bath (37c°). After 24 hours, the mixture was mixed using magnetic stirrer for an hour. The mixture was filtered using a gauze. The filtrate was then spread to the centrifuge pipes at a velocity of 3000 rpm for 15 minutes. Take the present, disregard the precipitate and position the glass of Petri dishes inside a 37c° drying oven. After drying, scrape the product and store it in the refrigerator for future use (Anessiny and Perez, 1993).

PARAMETERS USED IN THIS EXPERIMENT

THE AGE AND WEIGHT OF SEXUAL PUBERTY FOR MALES AND FEMALES

The age of sexual puberty for males was determined after the development of cloacal gland foam (Al-Salhie and Al-Swdani, 2013). The age of females sexual maturity is determined after egg production was reached 50% (Al-Salhie, 2012; Quinn Jr et al., 2008). Body weight at puberty and sexual maturity of both Males and females were recorded by sensitive balance.

THE RELATIVE WEIGHT OF THE TESTES

Body weight of the Japanese quail was measured at the end experiment by using a sensitive balance. In addition, all testes were removed and weighed after slaughtering birds.

SEMEN ANALYSIS

Procedures were performed using sperm obtained post-slaughter from the epididymis, isolating the epididymis from the testis. Samples were obtained by addition 1.5 ml of saline solution at 38°C with 100 mg of caudal epididymis in a sterile plastic Petri, and mixed well. Then, epididymis were blotted and mangled using a surgical blade for semen collection. Epididymis contents of the Japanese quail were obtained after cutting the tail of epididymis (Villaverde-Morcillo et al., 2016). Then, one drop of this mix was applied to slide under cover slip. Quantitative motility percentage was determined by counting motile and immotile spermatozoa per unit area. While, quantitative viability percentage was determined by counting viable and unviable spermatozoa per unit area (Parandin et al., 2008). Sperm morphology was done by adding two drops of warm Eosin/Nigrosin stain to the semen on a pre-warmed slide. Then, a uniform smear was air-dried. The stained slide was immediately examined under the microscope using x400 magnification (Bearden and Fuquay, 1980).

STATISTICAL ANALYSIS

All data were subjected to one-way variance analysis (ANOVA) and variations were deemed to be significant if P was < 0.05 according to SPSS Statistics (SPSS, 2009).

RESULTS

The effect of adding Lycium barbarum extracts from drinking water on age and weight of sexual puberty for males and females is shown in Table 1. There was a significant differences ($P < 0.05$) among the studied treatments in the age of sexual puberty and sexual maturity of males and females. Quail males and females in the third treatment recorded the lowest values compared to the control treatment. On the other hand, the results showed no significant differences between the experimental treatments for the weight at sexual puberty and maturity for

males and females. The results indicated a significant ($P<0.05$) increase in a relative weight of testes, sperm viability % , dead sperm %, abnormality % and individual motility% were recorded in the third treatment comparison with the control treatment. On the other hand, the third treatment was recorded the lowest values on dead sperm %, and a abnormality %compared to the control treatment.

Table (1): The Effect of adding Lycium barbarum extracts to drinking water on relative weight of testes sperm viability %, dead sperm %, abnormality % and individual motility% (Mean± SE).

	Treatments					
Parameters	T1	T2	T3	T4	T5	T6
Age of sexual puberty for males (day)	32.88^{a} ± 0.51	31.22^{b} ± 0.36	31.22^{b} ± 0.27	32.22^{ab} ± 0.22	32.33^{ab} ± 0.50	33^{a} ± 0.40
The weight at puberty sexual of males (gm)	168.77 ± 2.59	171.44 ± 4.52	176.88 ± 5.01	174.22 ± 4.85	178.77 ± 8.08	181.88 ± 4.78
Age of sexual maturity for females (day)	42.66^{a} ± 0.88	39.66^{b} ± 0.34	40^{b} ± 0.57	42^{a} ± 0.34	42^{a} ± 0.34	42.67^{a} ± 0.67
The weight at sexual maturity of females (gm)	246.16 ± 11.37	239.10 ± 1.18	244.71 ± 2.99	239.25 ± 6.18	238.77 ± 5.34	244.80 ± 7.33

DISCUSSION

In this study, the added Lycium barbarum fruit extract to drink water of Japanese quail beneficial effects on sexual performance. Decreased age of sexual puberty in males and females may be due to positive effects on Lycium barbarum on sexual development and fertility. Also, the findings suggest that Lycium barbarum may be improve the copulatory performance and the reproductive function through regulation of the secretion of sexual hormones. Increased sexual hormones levels lead to improve the sperm quantity and increase the relative weight of testes (Abdulrasool et al., 2014). Such results were consistent with the findings of Zhang et al. (2013). Lycium barbarum that regulates the synthesis and secretion of FSH and LH of pituitary gonadotropic cells (Shi et al., 2017). These hormones play an important role in the development of sexual cell activity and the sexual behavior of birds (Al-Salhie, 2018).

The results showed that Lycium barbarum fruit extract significantly increased testes weight and improved sperm quality. It could be suggested that polysaccharides from Lycium barbarum could enhance reproductive function in animals by two mechanisms: First, by regulating the secretion of sexual hormones, including gonadotropin, which promotes pituitary gland secretion of gonad hormone and regulates the hypothalamic-pituitary-gonadal axis in multiple ways. Second, Lycium barbarum fruit extract can increase the efficiency of sperm cells by supporting the cycle of lipid peroxidation and other DNA peroxide radicals (Abdulrasool et al. 2014). Higher hormone levels and higher accessory sexual organ weights. This led to improved sperm viability and individual motility, improved fertility, reduced sperm abnormalities, raised testes weight.

a-b Means in the same row are different significantly

T1 control, 400 mg/liter of Lycium barbarum extract (leaves, fruits, stems and root) T2, T3, T4, and T5 respectively. T6: 400 mg/liter of Lycium barbarum extract of the mixture of leaves, fruits, stems, and roots (100 mg each) per liter.

a-d Means in the same row are different significantly

T1 control, 400 mg/liter of Lycium barbarum extract (leaves, fruits, stems and root) T2, T3, T4, and T5 respectively. T6: 400 mg/liter of Lycium barbarum extract of the mixture of leaves, fruits, stems, and roots (100 mg each) per liter.

Table 2. Effect of adding Lycium barbarum extracts from drinking water on age and weight of sexual puberty for males and females of Japanese quail (Mean± SE).

CONCLUSIONS

Treatments						
Parameters	T1	T2	T3	T4	T5	T6
relative weight of testes	2.38 [b] ± 0.11	3.13 [a] ± 0.20	3.20 [a] ± 0.14	2.76 [b] ± 0.02	2.46 [b] ± 0.09	2.13 [b] ± 0.21
sperm viability %	63.33 [c] ± 1.66	91 [a] ± 2.08	90 [a] ± 2.88	78.33 [b] ± 1.66	78.33 [b] ± 1.66	67.33 [c] ± 1.45
Dead sperm %	36.66 [a] ± 1.67	9 [c] ± 2.08	10 [c] ± 2.88	21.66 [b] ± 1.66	21.66 [b] ± 1.67	32.66 [a] ± 1.45
abnormality %	25 [a] ± 2.89	8.66 [c] ± 0.88	6 [c] ± 1.15[c]	19 [b] ± 2.02	21.66 [ab] ± 1.67	24.33 [ab] ± 0.89
individual motility%	62.33 [d] ± 1.45	84 [b] ± 2.08	91 [a] ± 2.09	74.33 [c] ± 2.34	76.33 [c] ± 3.17	67 [d] ± 1.52

We may conclude that the fruits of Lycium barbarum extract have decreased the age of sexual maturity in males and females of Japanese quail. On the other hand, it has raised the relative weight of the testes and improved sperm quality.

ACKNOWLEDGMENTS

We would like to express my very great appreciation of the staff of quail farm, college of agriculture, the university of Basrah for the financial support to this study.

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